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ABSTRACT

The goal of industrial technology for industrial arts education in Texas is the education of society to enable its members to function efficiently in the world of advancing technology. Policymakers in Texas have chosen to organize the industrial technology curriculum around three technology clusters: visual communication, production, and energy technology. If industrial arts is to be justified as a part of tax-supported elementary and secondary education as mandated by Texas state legislation, it must contribute to the following goals: intellectual discipline; economic and occupational competence; citizenship and political understanding and competence; physical and environmental health, ecological balance, and safety; appreciation of culture, language, and life-style diversities and their corresponding aesthetic values; competence in personal and social relations; and use of leisure time. (This document includes discussions of the way in which Texas industrial arts programming contributes to attainment of the aforementioned goals, outlines of recommended industrial technology and industrial arts curricula for grades K-8 and 9-12, lists of specific competencies to be addressed at each of these levels, and guidelines for designing instructional implementation procedures.) (MN)

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THE RATIONALE FOR INDUSTRIAL TECHNOLOGY/INDUSTRIAL ARTS IN TEXAS

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NOTE: The term Industrial Technology in this document has been substituted for the traditional term "Industrial Arts." This is in line with trends in certain school districts in Texas and other states in the Nation.

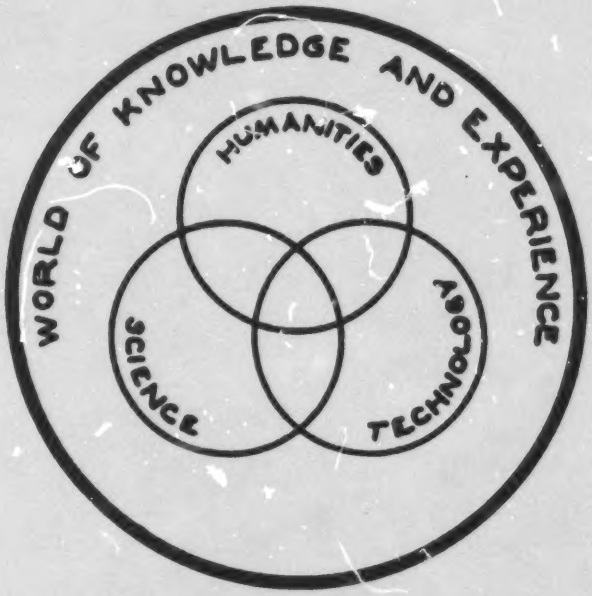
Texas Education Agency
201 East Eleventh Street
Austin, Texas 78701

DEFINITIONS

DEFINITIONS

> Technology...is the knowledge of human endeavors in creating and using tools, technique resources and systems to manage the man-made and natural environment for the purpose of extending human potential and the relationship of these to individuals, society and the civilization process. (Synder, 1980)

Technology is an integral part of the totality of human experience. As a discipline it is an integral part of knowledge. It interfaces with the sciences and humanities in the world of formal knowledge. The science, humanities, and technology disciplines support and complement each other. Education can be complete only when the parts are understood as they relate to the whole.



The World of
Knowledge and Experience

Industrial technology draws its content from that part of the broad discipline of technology which relates to industry. Specifically, industrial technology is an investigation of industry, a socioeconomic institution which researches and designs processes which utilize human and material resources to produce goods, services and information to meet the needs and wants of individuals and society. (Synder, 1980).

The term "industrial technology" in this document has been substituted for the traditional term "industrial arts." This is in line with trends in certain school districts in Texas and other states of the nation.

ROLE OF INDUSTRIAL TECHNOLOGY

IN

PUBLIC SCHOOLS

THE ROLE OF INDUSTRIAL TECHNOLOGY (INDUSTRIAL ARTS)
IN PUBLIC SCHOOLS

Historically the purpose of education has been to fulfill the most pressing needs of society. Taxpayers, legislators, philosophers, educators, and citizens consciously and unconsciously influence the direction in which a society and education moves. This confluence of ideas from the school's constituency produces a variety of needs. Those needs which are most commonly shared are the ones to which the tax supported system of education speaks. Industrial technology, (industrial arts), which has been an integral part of public school education in Texas and the nation for many years, speaks in a unique way to the continuing needs of every level of society. As technology changes, society's educational needs change.

Fundamental to the existence of industrial technology, (industrial arts) in public schools is the belief that technology, as an evolving discipline, is a worthy and viable field of study. Further, the pervasive influence of technological innovation on society mandates that a truly "educated" population possesses an understanding of technology. The level of technological literacy should be commensurate with the extent of technology within the society.

Rationale for such a belief springs from the basic precepts of democracy and the free enterprise system. Maintenance of economic stability and enhancement of living standards in this post-industrial society is based, to a

large extent, on the ability of citizens to comprehend and utilize existing and emerging technological innovation. Meaningful participation by an electorate in a technologically advanced democracy is dependent upon their having a functional level of technological literacy. This need exists among all society as it seeks equality of opportunity for men and women, minorities, and the handicapped. The goal of industrial technology in public schools of Texas is the education of society to enable its members to function efficiently in the world of advancing technology.

SCOPE OF INDUSTRIAL TECHNOLOGY

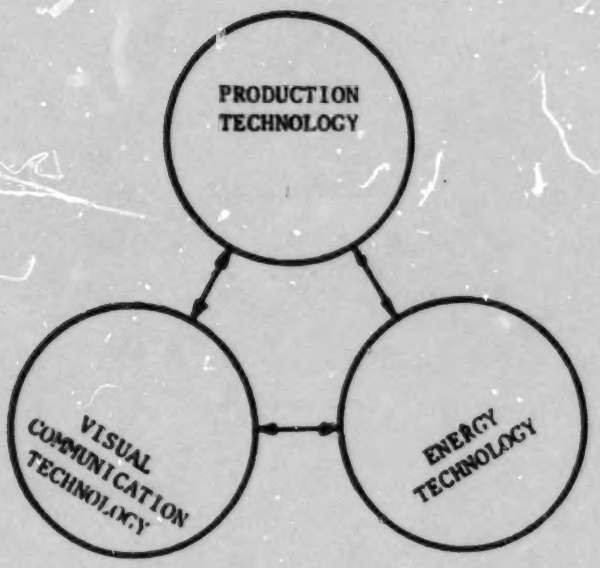
In the past, industrial technology, (industrial arts), consisted of a study of separate and discrete crafts which grew out of trade skills and which were applicable to distinct material areas. School laboratories were organized and equipped around topics such as woods, metals, and drafting. Growth and expansion of new topics of study during the past half century has rendered the traditional industrial technology (industrial arts) curriculum in Texas inadequate to meet the demands of the times.

This approach to curriculum organization is no longer adequate to educate the youth of the State of Texas in view of the rapid expansion of the technological world. It is no longer economically or administratively feasible, or educationally sound, to deal individually with such a myriad of topics. A vastly more complex and enlarging body of subject matter requires a restructuring of industrial technology if its meaning and significance are to be apprehended.

During the past decade, structuring of the industrial technology curriculum has received much attention on a national basis. Growing out of numerous efforts across the nation in recent years, strides have been made in the development of curriculum derivation systems which tend to simplify the process. Rather than organize around seven or more technical areas with many possible courses, it has

become necessary to identify common threads around which to organize a more viable industrial technology curriculum. If public school students, particularly at the middle school/ junior high school levels, are to have an opportunity to become acquainted with the full panorama of technological concepts, reorganization of the curriculum must take place. Administrative limitations and general curriculum requirements often leave no more than one year in a student's schedule for a study of technology. Therefore, a restructuring must take place if students are to be provided an opportunity to experience the realistic industrial technological world.

In recognition of this need, the educational leadership in Texas has chosen to organize the industrial technology curriculum around three technology clusters: visual communication technology, production technology, and energy technology. For educational purposes, these three clusters comprise the industrial technological world. They are universals which must be studied and understood because they are the systems which are employed to meet human needs in adapting to and controlling the environment. Our technological society has reached its potential through these systems and it is through these systems that its creative endeavors have been expressed and achieved. Therefore these three universals of industrial technology and their relationships must be understood in order to comprehend the technological world. They are avenues to technological literacy.



Universals of Industrial Technology

These universal elements are interrelated. They are mutually supportive and interactive. None of the three elements can function alone in a meaningful and productive way. Yet each contains a core around which a large body of ideas and concepts can be clustered. The elements may be integrated into a larger, meaningful wholeness through which the industrial technological world may be understood. On the other hand each cluster, or technology, lends itself to organization into meaningful sub-parts or concepts which are convenient for teaching in limited time periods found in secondary schools.

Visual Communication: A Technology Universal

Communication is an essential element of the technological world for socially communicative purposes as well as for industrial technology. The earliest study of industrial technology in public schools was drafting, a competency which was thought to be essential for American industry to compete with European industry. However, industrial communication has grown to be more than drafting: it includes photography, printing through several mediums, reproduction systems of many kinds, and computers. Again, computer aided design is used extensively to communicate ideas more effectively, and economically.

Visual communication technology is a necessity in all industrial endeavors in the technological world. Whether in planning and producing an object, constructing a building, advertising and marketing an industrial product, or storing and retrieving information, a system of communication is essential. Without this sophisticated complex of communication sub-systems, the effort of industry to produce goods and services could not be successful. Visual communication technology is necessary in every human endeavor. It is an important part of education of all who live and work in a technological world.

Energy: A Technology Universal

The traditional energy curriculum in public schools has

been limited largely to a study of basic electricity and small gasoline engines. These were interpreted to be discrete topics of study with very limited possibility for integration or expansion. With the rapid development of high technology, the potential of an evolving energy technology curriculum has multiplied. Energy is the driving force for the technological revolution. Whether the energy is electrical, solar, fosil fuel, wind or other, it is harnessed to produce goods and services. All of society's endeavors require the use of energy, whether for transporting people and goods, heating, lighting, energizing computers, or driving machines. It follows then that all of society's productive endeavors require some form of energy. Without an understanding of energy sources, conversion systems, and transmission systems, appreciation of society's efforts, whether through production of goods or through communication, would be incomplete. Energy as a basic resource is essential in the future growth and development of high technology. Energy, as a technology universal, provides a logical cluster around which to organize a part of the public school industrial technology curriculum. It is an important part of the industrial technology curriculum in public schools.

Production Technology: A Technology Universal

The mastery of the environment is attributable to society's ability to create tools with which to produce goods

to meet its needs. These products of industry serve the basic needs and requirements of society. It is with tools that society changes and controls the environment. Creative ideas are fulfilled through the use of tools. Tools, materials, and processes are employed in both the simple and complex production systems of American industry. Production technology is important because it touches the lives of all people as producers and consumers. It must be understood and appreciated as part of the free enterprise system with its economic and social consequences. Whether the product is a home, a means of transportation, or an object of personal or public use or convenience, production technology is the means through which man's needs are met. Indeed, production technology is so significant in the lives of all members of society that its study should be a part of the formal education of all those who attend public schools. It is, therefore, an important part of the industrial technology curriculum in public schools.

INDUSTRIAL TECHNOLOGY

AND

GOALS FOR PUBLIC SCHOOLS EDUCATION IN TEXAS

INDUSTRIAL TECHNOLOGY AND THE GOALS OF EDUCATION

The "Goals for Public School Education" state the purpose of tax-supported elementary and secondary schools in Texas. Therefore, if industrial technology is to be justified as a part of public education in the State of Texas, it must be on the basis of its contribution to these goals.*

STUDENT DEVELOPMENT

The public schools should help each student to develop personal knowledge, skills, and competence to maximum capacity, and to learn behavior patterns which will make each a responsible member of society. In terms of their individual ability, all students should achieve:

(1) Intellectual Discipline

Competence in the traditionally accepted fundamentals of reading, writing, and arithmetic in the early elementary grades, accompanied by studies in higher mathematics, science, history, free enterprise system, English and other languages, as they progress through the upper grades. These should be accompanied by a wide variety of optional courses.

Skill in the logical processes of search, analysis, evaluation, and problem solving.

Competence and motivation for continuing self-evaluation, self-instruction, and adaptation to a changing environment.

Competence in reading, communication, and other language arts skills according to grade level and individual ability.

(2) Economic and Occupational Competence

Knowledge of the fundamental economic structure and processes of the American system, of the contributions of free enterprise, and of the opportunities for individual participation and success in the system.

Occupational skills prerequisite to enter and advance in the economic system and/or academic preparation for acquisition of technical or professional skills through post-high school training.

Competence in the application of economic knowledge to practical economic functions such as planning and budgeting for the investment of personal income, calculating tax obligations, financing major purchases, and obtaining desirable employment.

(3) Citizenship and Political Understanding and Competence

Knowledge about the United States and Texas systems of government and their political subdivisions.

Competence in judging the merit of comparative political systems and ideologies with emphasis on democratic institutions, the American heritage, the responsibilities and privileges of citizenship, and the comparative merits of candidates for political position.

Skills for communicating with public officials at different levels of government.

Skills for participating in the processes of public and private political organizations and for influencing decisions made by such organizations.

(4) Physical and Environmental Health, Ecological Balance, and Safety

Knowledge about the requirements of personal hygiene, nutritional consumption, and physical exercise essential to the maintenance of personal health. Knowledge about the dangers to health from addiction to harmful practices or consumption of harmful materials.

Skill in sports and other forms of recreation which will permit life-long enjoyment of physical exercise.

Competence in recognizing and preventing environmental, ecological, and health problems.

Knowledge and experiences to provide information and develop skills and values needed to perform daily activities in a safe manner free from injury or other losses.

(5) Appreciation of Culture, Language, and Life-Style Diversities and Their Corresponding Aesthetic Values

Knowledge of the art, music, literature, drama, and other culturally related forms of various culture groups and their contributions.

Knowledge and competence in at least one of the major languages of the state other than English and an understanding of bilingualism.

(6) Competence in Personal and Social Relations

Knowledge about basic psychological, sociological, and cultural factors affecting human behavior.

Skills in interpersonal and group relations, and information of ethical and moral standards of behavior.

Competence for adjusting to changes in personal status and social patterns.

Skills for coping with stress and pressure.

Development of a self-image that builds self-concepts of a positive nature.

(7) Use of Leisure Time

Competence and skill in creative and responsible use of leisure time.

*Adopted by the State Board of Education October, 1970
(Third Revision November, 1979)

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A primary purpose of the study of industrial technology in public schools is to assist students in the development of personal skills, knowledge, and competences which will make each a responsible and productive member of society. In order to meet its responsibility to the society which supports it, the industrial technology curriculum interfaces with each of the student development areas of the "Goals for Public School Education in Texas." Industrial technology and the goals of public school education are discussed below.

Intellectual Discipline: A Goal of Public School Education

> Competence in the traditionally accepted fundamentals of reading, writing, and arithmetic in the early elementary grades, accompanied by studies in higher mathematics, science, history, free enterprise system, English and other languages, as they progress through the upper grades. These should be accompanied by a wide variety of optional courses.
>
> Skill in the logical processes of search, analysis, evaluation, and problem solving.
>
> Competence and motivation for continuing self-evaluation, self-instruction, and adaptation to a changing environment.
>
> Competence in reading, communication, and other language arts skills according to grade level and individual ability.

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INDUSTRIAL TECHNOLOGY AND THE GOAL OF INTELLECTUAL DISCIPLINE

Industrial technology facilitates the development of logical methods of thinking and problem solving. The subjects of reading, writing and arithmetic are integrated into the study of technology in a variety of ways. Methods of structured thinking such as the process of search, analysis, evaluation, and problem solving, are taught in unique ways in industrial technology. Simulation of the technological world in which the students will live and work results in effective learning of these methods in the technology laboratory. With the knowledge and skills gained, the learner will have the experience necessary to cope with problem solving situations which may be encountered. The individual will be able to communicate in the industrial world through forms of expressions learned in industrial technology.

Industrial technology contributes to intellectual development through opportunities to:

- investigate analytical methods of problem solving.
- recognize those core elements that are common to all industrial technology.
- develop an awareness of information and communication systems used by industry.

- analyze processes used in different technological areas.
- expand technological literacy.
- identify the uniqueness of different technologies.
- adapt and control the industrial environment through manual and automated systems.
- emphasize the need of standards within our technological society.

Economic and Occupational Competence: A Goal of Public School Education

Knowledge of the fundamental economic structure and processes of the American system, of the contributions of free enterprise, and of the opportunities for individual participation and success in the system.

Occupational skills prerequisite to enter and advance in the economic system and/or academic preparation for acquisition of technical or professional skills through post-high school training.

Competence in the application of economic knowledge to practical economic functions such as planning and budgeting for the tax obligations, financing major purchases, and obtaining desirable employment.

INDUSTRIAL TECHNOLOGY AND THE GOAL OF ECONOMIC AND OCCUPATIONAL COMPETENCE

Through a study of industrial technology, students have a unique opportunity to acquire economic and

occupational competence in technology areas. Experience in production technology, energy technology, and visual communication technology, three universal elements of the American industrial system, provides meaningful studies which contribute to the economic and occupational needs of public school youth. Industrial technology contributes to economic and occupational competence through opportunities to:

- investigate occupational opportunities in the industrial world which lead to better informed occupational choices.
- develop a knowledge of the essential elements of the system through which goods and services are produced in the American Free Enterprise system.
- seek equal access to the world of work.
- investigate the historical development of technology, of its current status, and an interest in its advancement.
- develop consumer awareness and competence to make reasoned decisions in the marketplace.
- develop safe work habits.
- use safely the tools, machines, and materials of industry.
- develop communications and computational skills in their application to the industry.

. develop work habits essential for success in the industrial world.

. develop a competence in servicing industrial products and equipment.

Citizenship and Political Understanding and Competence: A Goal of Public School Education

Knowledge about the United States and Texas Systems of government and the political subdivisions.

Competence in judging the merits of comparative political systems and ideologies with emphasis on democratic institutions, the American heritage, the responsibilities and privileges of citizenship, and the comparative merits of candidates for political position.

Skills for communicating with public officials at different levels of government.

Skills for participating in the processes of public and private political organizations and for influencing decisions made by such organizations.

INDUSTRIAL TECHNOLOGY AND THE GOALS OF CITIZENSHIP AND POLITICAL UNDERSTANDING AND COMPETENCE

Continued prosperity of American society depends on a population that understands the responsibility of citizenship, the political process, and the relationship between American industrial and political institutions. Industrial technology is in a unique position to provide first-hand experiences

and understanding of the democratic process and the responsibility of citizenship. Industrial technology contributes to citizenship and political understanding and competence through opportunities to:

- practice democratic principles through youth leadership activities.
- experience the role of individual leadership in group activities.
- investigate ways in which special interest groups, unions and industrial lobbies influence American industry.
- identify governmental and industrial policies that affect industry.
- incorporate accepted standards in activities related to a technological society.
- investigate ways in which industry operates most efficiently in a democratic system.
- experience the relationship of authority and responsibility through pupil personnel activities.

Physical and Environmental Health, Ecological Balance, and Safety: A Goal of Public School Education

Knowledge about the requirements of personal hygiene, nutritional consumption, and physical exercise to the maintenance of personal health.

Knowledge about the dangers to health from addiction to harmful practices or consumption of harmful materials.

Skills in sports and other forms of recreation which will permit life-long enjoyment of physical exercise.

Competence in recognizing and preventing environmental, ecological, and health problems.

Knowledge and experiences to provide information and develop skills and values needed to perform daily activities in a safe manner free from injury or other losses.

INDUSTRIAL TECHNOLOGY AND THE GOAL OF PHYSICAL AND ENVIRONMENTAL HEALTH, ECOLOGICAL BALANCE, AND SAFETY

Our environmental health is affected directly and indirectly by technology. Technology solves problems and it creates problems. There is a need for each individual to realize that problems result from human needs and developments of technology. Although this topic may be treated in many curriculum areas, it surely should be dealt with in industrial technology where there is opportunity to identify and experience first hand the contributions of technology. Industrial technology contributes to physical and environmental health, ecological balance, and safety through opportunities to:

. develop safe work habits in the operation and use of tools and equipment.

- establish and maintain a safe working environment.
- research the national engineering, environmental, and safety standards.
- investigate the effects of industrial production on the environment.
- research industrial product development, product consumption, by-product development, recyling, and waste disposal.
- develop awareness of the proper handling of environmentally hazardous materials.
- control the development and use of technology to meet the needs of physical and mental health.

Appreciation of Culture, Language, and Life-Style Diversities and their Corresponding Aesthetic Values: A Goal of Public School Education

Knowledge of the arts, music, literature, drama, and other culturally related forms of various culture groups and their contributions.

Knowledge and competence in at least one of the major languages of the state other than English and an understanding of bilingualism.

INDUSTRIAL TECHNOLOGY AND THE GOAL OF APPRECIATION OF CULTURE, LANGUAGE, AND LIFE-STYLE DIVERSITIES AND THEIR CORRESPONDING AESTHETIC VALUES

Appreciation of the American culture is a goal of great importance, and every educational discipline must

accept responsibility to communicate such an appreciation. America is a successful technological culture founded in the inventiveness and creative applications of immigrants from diverse cultural societies who have helped America grow. Industrial technology is the only curriculum area in the public schools which purports to deal exclusively with the study of technology. It, therefore, has the responsibility to interpret and transmit that aspect of the American culture to students. Industrial technology contributes to the appreciation of culture, language, and life-style diversities and their corresponsing aesthetic values through opportunities to:

- research how past and present technology is shaping our culture.
- investigate how anticipated technological change may affect future culture.
- investigate the free enterprise system and its contributions to American culture.
- explore the direct relationship occupational choice has upon life styles.
- explore the importance of bilingual competencies in communicating industrial technology.
- recognize the importance of aesthetic values

in planning, design and production of industrial products.

Competence in Personal and Social Relations: A Goal of Public School Education

Knowledge about basic psychological, sociological, and cultural factors affecting human behavior.

Skills in interpersonal and group relations, and information of ethical and moral standards of behavior.

Competence for adjusting to changes in personal status and social patterns.

Skills for coping with stress and pressure.

Development of a self-image that builds self-concepts of a positive nature.

INDUSTRIAL TECHNOLOGY AND THE GOAL OF COMPETENCE IN PERSONAL AND SOCIAL RELATIONS

Since most of life's activities require interaction with other people, successful adulthood can only be achieved with a positive self-image and understanding of the factors involved in social relations. Industrial technology can provide an opportunity for students to develop interpersonal skills and an understanding of themselves and their role in adapting to a changing technological society. Industrial technology contributes to competence in personal and social relations through

opportunities to:

- develop and practice interpersonal skills through cooperative activities dealing with planning, organizing and controlling production processes.
- establish a positive self-image by developing, producing and exhibiting quality work.
- recognize the ethical and moral responsibilities of individuals to others in a technological society.
- trace the expansion and evolution of technology and its effect on society and the status of the individual.
- develop skills for adapting to changes in technology and society.
- recognize the equality of opportunity for men and women, minorities and the handicapped in industrial settings.
- participate in youth leadership activities.

Use of Leisure Time: A Goal of Public School Education

Competence and skill in creative and responsible use of leisure time.

INDUSTRIAL TECHNOLOGY AND THE GOAL OF USE OF LEISURE TIME

In an age when such high priority is placed on efficiency and achievement, use of creative and responsible leisure time is often overlooked. It is important to give attention to this area now and for the future.

Industrial technology can help students learn creative skills and responsible use of leisure time through its unique activities. Educating students about responsible use of leisure time is important because today's students will be faced with the increased leisure time of the future. Industrial technology contributes to the development of competencies in the use of leisure time through opportunities to:

- assess interests and leisure time choices.
- explore opportunities in technology education that will assist in identifying worthy avocational pursuits and responsible leisure time activities.
- develop proper attitudes and basic skills dealing with a variety of tools, materials, and processes which may be of value in leisure time activities.
- practice activities which promote physical

and mental well being.

. experience new skills and knowledge through continuing education.

THE INDUSTRIAL TECHNOLOGY CURRICULUM

GOALS AND ASSUMPTIONS

Technology is a dominant characteristic of the American culture. As such, there is a need for the development of skills necessary for coping with problems that are encountered in living and working in the technological world.

A primary goal of industrial technology in public schools is, therefore, to prepare youth to function effectively in a world of advancing technology. The objectives of industrial technology are based on the assumption that a technologically literate person will be competent to:

- solve technological problems.
- make wise selections of products and services of industry.
- assess interest in and awareness of career opportunities and requirements.
- use problem solving techniques to plan and design products using visual communication, energy, and production techniques.
- explore the past, present, and future of industrial technology and its influence on society.
- use safely the tools, machines, materials, and processes of industry.
- select and prepare for productive employment in the world of work.
- participate effectively as a member of an industrial/democratic society.

. communicate effectively: man to man; man to machine; machine to man and machine to machine.

. identify and pursue avocational interests.

GOALS OF INDUSTRIAL TECHNOLOGY IN TEXAS K-12

Based on the nature of the American culture, the technological system, the needs of students, and the goals of public education in Texas, industrial technology seeks to achieve the following objectives in secondary schools.

Industrial technology provides opportunities for students to:

. investigate the relationship of visual communication, energy, and production technology in the technological system.

. explore entrepreneurship and its place within the free enterprise system.

. exhibit responsibility and leadership skills by using democratic principles.

. develop competencies in the safe use of tools, machines, materials, and processes of technology.

. solve technological problems through the application of competencies in the humanities and sciences.

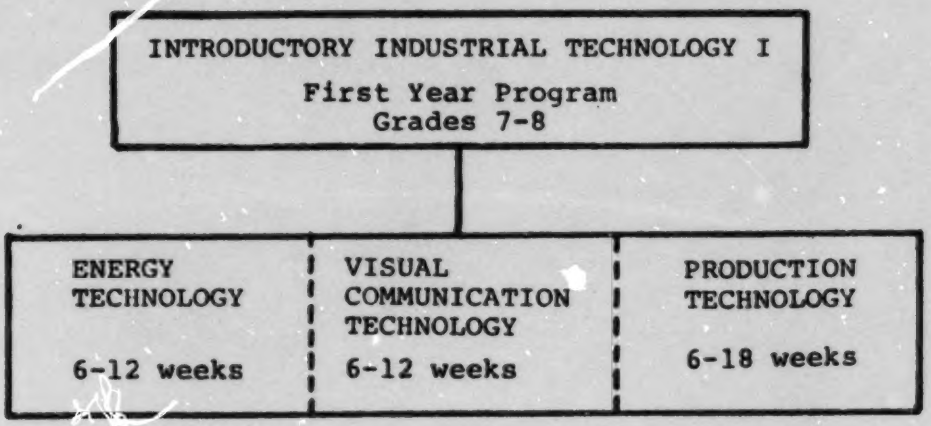
. investigate the nature of the technological world--past, present, and future and its influence on our society.

- develop interest and awareness in career opportunities and leisure time activities in a technetronic society.
- make wise selections of consumer products and services of technological society.

INDUSTRIAL TECHNOLOGY

The goals of industrial technology are achieved through diverse course offerings in grades 7 through 12 in each of the three technology clusters. The courses are organized around three levels which are: Introductory industrial technology, general industrial technology, and advanced industrial technology.

Introductory industrial technology I and II are designed for grades seven and eight. Introductory Industrial Technology I is a first year program and covers essential elements in visual communication technology, energy technology, and production technology.



OBJECTIVES OF INTRODUCTORY INDUSTRIAL TECHNOLOGY
GRADES 7-8

Introductory Industrial Technology provides opportunities for students to:

- use problem solving techniques to plan and design products, using visual communication, energy, and production techniques.
- develop an awareness of skills related to successful employment and explore business practices in a free enterprise system.
- participate and function as a member of a democratic society.
- practice safe use of tools, machines, materials, and processes of industrial technology.
- be aware of the relationship between industrial technology and science, mathematics, social studies, and language arts.
- explore the past, present and future of industrial technology and study its influence on our society.
- explore opportunities in industrial technology that will assist individuals in identifying their interests, abilities, values, and needs relative to defining prospective occupational, educational, and avocational pursuits.

(c) Introductory industrial technology, grades seven-eight, shall include the essential elements common to all programs. Students may take the introductory industrial technology program for one or two years. Students taking the first year of the program or Introductory Industrial Technology I may study six-12 weeks of visual communications technology, six-12 weeks of energy technology, and six-18 weeks of production technology. Students taking the second year of the program or Introductory Industrial Technology II may study 12-24 weeks of construction technology and 12-24 weeks of manufacturing technology.

(1) Concepts and skills in the application of safety procedures. The student shall be provided opportunities to:
   (A) demonstrate safe operation and use of selected tools and equipment to avoid injury; and
   (B) maintain safe conditions in the laboratory.

(2) Concepts and skills related to planning, designing, and problem solving. The student shall be provided opportunities to:
   (A) plan and design industrial products of the student's choice;
   (B) measure accurately using metric or customary units;
   (C) complete itemized list of materials; and
   (D) make working drawings of projects.

(3) Concepts and skills related to the tools, materials, and process of technology. The student shall be provided opportunities to:
   (A) solve industrial problems by utilizing a variety of industrial materials;
   (B) use correctly selected hand and machine tools; and
   (C) select the most suitable process to complete a project.

(4) Concepts and skills related to the past, present, and future of technology. The student shall be provided opportunities to:
   (A) recognize ideas and inventions of the past and present; and
   (B) relate technological change to the skills needed for the future.

(5) Concepts and skills related to evaluating products and services of technology. The student shall be provided opportunities to:
   (A) recognize good design and construction;
   (B) evaluate products based on given standards or applications;
   (C) service industrial products and equipment; and
   (D) develop criteria for selecting, purchasing, and contracting services.

(6) Leadership concepts and skills. The student shall be provided opportunities to:
  (A) identify characteristics and responsibilities of leaders and effective group members;
  (B) participate in orderly meetings conducted according to parliamentary procedure (optional on occupational orientation);
  (C) function effectively on committees (optional in occupational orientation);
  (D) plan and conduct leadership activities; and
  (E) prepare for effective citizenship and participation in our democratic society.

(7) Concepts and skills related to successful employment. The student shall be provided opportunities to:
  (A) develop an awareness of employment opportunities in chosen field;
  (B) practice correct procedures for job application and interview;
  (C) develop the ability to take and follow both oral and written directions;
  (D) practice punctuality and dependability;
  (E) observe rules and standards of the work place;
  (F) demonstrate an ability to work with others harmoniously;
  (G) develop responsibility and the ability to follow through on assigned tasks; and
  (H) exhibit productive work habits and attitudes.

(8) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:
  (A) recognize opportunities and options for business ownership;
  (B) identify entry-level procedures, planning processes, and terms needed to open a business; and
  (C) develop an understanding of the role of small business in the free enterprise system.

(d) Introductory Industrial Technology I (grades seven-eight - ½-1 unit). Every school offering Introductory Industrial Technology I shall provide the essential elements common to introductory industrial technology and the following essential elements:

(1) Concepts and skills related to visual communications technology. The student shall be provided opportunities to:
  (A) make freehand technical drawings;
  (B) apply accpeted lettering practices and styles;
  (C) construct multiview projections with instruments;
  (D) describe object size by standard dimensioning practice;
  (E) describe objects through pictorial methods;
  (F) apply design principles to composition and layout techniques;

(G) operate standard reproduction and duplicating equipment;
(H) use standard finishing techniques;
(I) produce products using accepted methods of image generation;
(J) study the types and uses of visual communications equipment;
(K) use computer software to design and make drawings;
(L) explore the use of function codes in computer numerical control of production machines; and
(M) use data base software to assist to collecting, storing, retrieving, and applying information for industrial applications.

(2) Concepts and skills related to energy technology. The student shall be provided opportunities to:
(A) use apparatus and devices that demonstrate the generation, conversion, and control of mechanical, electrical, and pneumatic-hydraulic power;
(B) construct static or working models or examples of devices that generate, convert, or control energy;
(C) utilize computers for the collection and analysis of data relevant to energy technology;
(D) compare transportation systems that move people and materials by land, sea, air, and space;
(E) plan and implement the controlled movement of robots;
(F) use instrumentation with computers to monitor data-based systems;
(G) compare transmission systems that move energy by electrical, electronic, mechanical, and pneumatic-hydraulic technologies;
(H) construct static or working models that demonstrate devices or systems used to move people and materials;
(I) construct static or working models that demonstrate devices or systems that transmit energy; and
(J) read and interpret maps, charts, and schedules.

(3) Concepts and skills related to production technology. The student shall be provided opportunities to:
(A) apply industrial organization and management systems by planning, organizing, and controlling production processes;
(B) apply primary industrial processes of layout, testing, separating, and cutting, drilling and boring, shaping, and forming, casting, laminating, coating, decorating, joining, and finishing;
(C) research the recycling of industrial materials;
(D) plan and implement the various steps in the construction process;
(E) research the transformation of raw materials into finished products;
(F) plan and implement mass production activities;
(G) demonstrate techniques and processes used in automated production systems; and
(H) use computers in planning, production, quality control, and management of production systems.

INTRODUCTORY INDUSTRIAL TECHNOLOGY II
SECOND YEAR
GRADE 8

PRODUCTION TECHNOLOGY	
MANUFACTURING 12-24 weeks	CONSTRUCTION 12-24 weeks

(e) Introductory Industrial Technology II (grade eight - ½-1 unit). Every school offering Introductory Industrial Technology II shall provide the essential elements common to introductory industrial technology and the following essential elements:

(1) Concepts and skills related to production technology in the area of manufacturing. The student shall be provided opportunities to:
- (A) participate in activities involving product researching, designing, and marketing;
- (B) investigate financial resources needed in industrial production;
- (C) plan and implement mass production activities;
- (D) apply industrial organization and management systems by planning, organizing, and controlling production processes;
- (E) develop production charts and graphs;
- (F) demonstrate an awareness of automated systems used in manufacturing;
- (G) recognize basic material standards and terminology used in industry;
- (H) apply the basic industrial processes to manufacturing;
- (I) research the recycling of manufacturing materials; and
- (J) use computers in planning, production, quality control, and management of production systems.

(2) Concepts and skills related to production technology in the areas of construction. The student shall be provided the opportunities to:
- (A) analyze those processes involved in selecting and acquiring a construction site;
- (B) design and construct a foundation, floor, wall, ceiling, and roof;
- (C) research pre-fabricated systems;
- (D) participate in electrical systems installation activities;
- (E) practice simple plumbing techniques;
- (F) practice trimming and finishing techniques;
- (G) explore remodeling procedures;
- (H) practice basic masonry techniques;
- (I) discuss contracting and subcontracting practices;

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(J) develop a basic knowledge of landscaping;
(K) research new construction materials and methods;
(L) explore energy conservation principles involved in construction;
(M) explore techniques and processes used in automated production systems; and
(N) research the recycling of construction materials.

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INDUSTRIAL TECHNOLOGY
GRADES 9-12

The industrial technology curriculum in the high school is designed to fulfill two specific needs. General industrial technology fulfills the needs of students who did not have opportunity to enroll in introductory industrial technology in grades seven and eight. The industrial technology program in grades nine to twelve is designed for those who wish to study the specific technologies in greater depth. The objectives of industrial technology in grades nine to twelve are as follows.

Objectives of Industrial Technology Grades 9-12

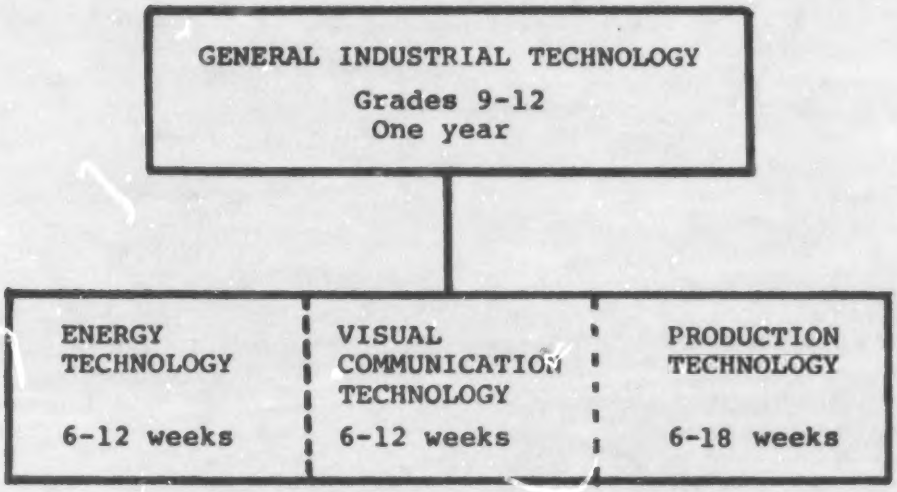
Industrial technology in grades 9-12 includes courses in each of the three technologies at general and advanced levels.

Industrial technology, grades 9-12, provides opportunities for students to:

- make and execute decisions necessary to the solution of problems in our technological society in relation to visual communication, energy, and production.
- act responsibly, to practice acceptable work habits and entrepreneurship, and to grow mentally and socially.
- develop leadership competencies for living in a democratic society.

- exhibit safe use of tools, machines, materials and processes common to industrial technology.
- apply the relationship between industrial technology and science, mathematics, social studies, and language arts.
- investigate the past, present and future characteristics of industrial technology and to evaluate its influence on our society.
- assess one's abilities and interests, to make career and leisure-time choices, and to pursue studies in the technologies of communication, energy and/or production.
- select, use and maintain products and services of industrial technology.

GENERAL INDUSTRIAL TECHNOLOGY



(a) General industrial technology (½-1 unit) is designed for students who have not had introductory industrial technology in the middle school. The program structure and content for general industrial technology are the same as in introductory technology with the exception that it is only a one-year program. The high school common core is utilized rather than the middle school core. Teaching strategies for this course are modified to accommodate the high school student. Industrial technology courses grades 9-12 shall include the essential elements common to all programs.

(1) Concepts and skills in the applications of safety procedures. The student shall be provided opportunities to:
   (A) demonstrate safe operation of selected tools and equipment;
   (B) maintain safe conditions in laboratories; and
   (C) evaluate laboratories and facilities for unsafe conditions.

(2) Concepts and skills in planning, designing, and problem solving. The student shall be provided opportunities to:
   (A) plan and design industrial products of the student's choice;
   (B) apply problem-solving techniques to the design process;
   (C) complete itemized list of materials; and
   (D) prepare working drawings using standard symbols and conventions.

(3) Concepts and skills related to evaluating products and services of technology. The student shall be provided opportunities to:
   (A) recognize good design and construction;
   (B) practice evaluation of products based on given standards or applications;
   (C) practice the servicing of industrial products and equipment;
   (D) develop criteria for selecting, purchasing, and contracting services; and
   (E) relate wise consumer choices to the free enterprise system.

(4) Leadership concepts and skills. The student shall be provided opportunities to:
   (A) identify characteristics and responsibilities of leaders and effective group members;
   (B) participate in orderly meetings conducted according to parliamentary procedure (optional to occupational orientation);
   (C) function effectively on committees (optional in occupational orientation);
   (D) plan and conduct leadership activities; and
   (E) prepare for effective citizenship and participation in our democratic society.

(5) Concepts and skills related to successful employment. The student shall be provided opportunities to:
   (A) develop an awareness of employment opportunities to chosen field;
   (B) practice correct procedures for job application and interview;
   (C) develop the ability to take and follow both oral and written directions;
   (D) practice punctuality and dependability;
   (E) observe rules and standards of the work place;
   (F) demonstrate an ability to work with others harmoniously;
   (G) develop responsibility and the ability to follow through on assigned tasks; and
   (H) exhibit productive work habits and attitudes.

(6) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:
   (A) recognize opportunities and options for business ownership;
   (B) identify entry-level procedures, planning processes, and terms needed to open a business; and
   (C) develop an understanding of the role of small business in the free enterprise system.

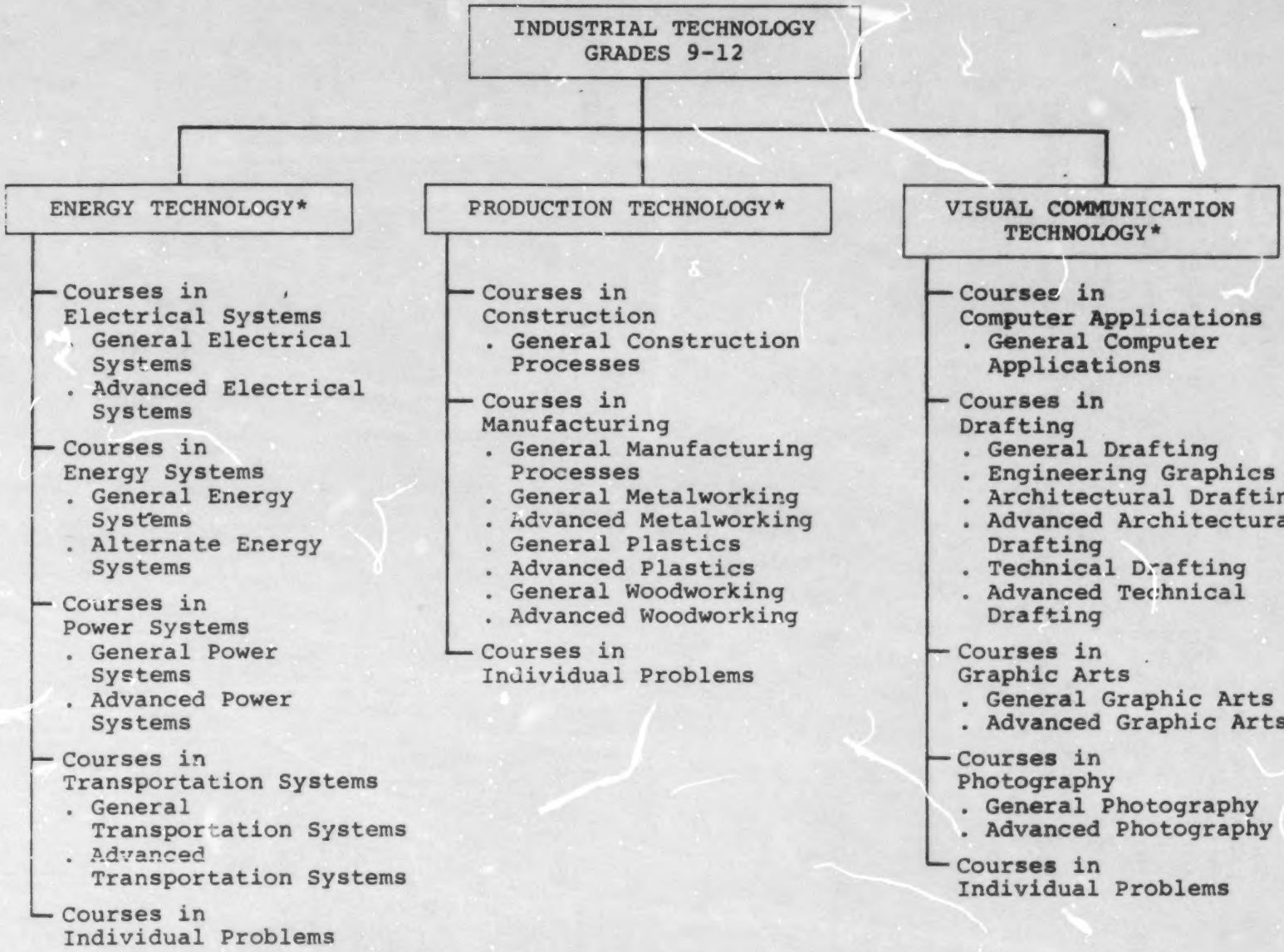
(7) Concepts and skills involving the tools, materials, and processes used in technology. The student shall be provided opportunities to:

(A) become proficient in the use of applicable tools, machines, and equipment;

(B) understand the properties of a wide range of industrial materials through testing;

(C) gain familiarity with the processes of various technologies; and

(D) practice conservation and recycling of industrial materials.



*ALL COURSES MAY BE OFFERED FOR ½-1 UNIT CREDIT

Industrial technology courses, grades 9-12 cover specific topics of study at general and advanced levels in each of three technologies. Each of the courses offered should cover all of the following essential elements listed below and the essential elements listed under each of the courses.

COMMON ESSENTIAL ELEMENTS
INDUSTRIAL TECHNOLOGY, GRADES 9-12

(1) Concepts and skills in the applications of safety procedures. The student shall be provided opportunities to:
   (A) demonstrate safe operation of selected tools and equipment;
   (B) maintain safe conditions in laboratories; and
   (C) evaluate laboratories and facilities for unsafe conditions.
(2) Concepts and skills in planning, designing, and problem solving. The student shall be provided opportunities to:
   (A) plan and design industrial products of the student's choice;
   (B) apply problem-solving techniques to the design process;
   (C) complete itemized list of materials; and
   (D) prepare working drawings using standard symbols and conventions.
(3) Concepts and skills related to evaluating products and services of technology. The student shall be provided opportunities to:
   (A) recognize good design and construction;
   (B) practice evaluation of products based on given standards or applications;
   (C) practice the servicing of industrial products and equipment;
   (D) develop criteria for selecting, purchasing, and contracting services; and
   (E) relate wise consumer choices to the free enterprise system.
(4) Leadership concepts and skills. The student shall be provided opportunities to:
   (A) identify characteristics and responsibilities of leaders and effective group members;
   (B) participate in orderly meetings conducted according

to parliamentary procedure (optional to occupational orientation);
(C) function effectively on committees (optional in occupational orientation);
(D) plan and conduct leadership activities; and
(E) prepare for effective citizenship and participation in our democratic society.

(5) Concepts and skills related to successful employment. The student shall be provided opportunities to:
(A) develop an awareness of employment opportunities to chosen field;
(B) practice correct procedures for job application and interview;
(C) develop the ability to take and follow both oral and written directions;
(D) practice punctuality and dependability;
(E) observe rules and standards of the work place;
(F) demonstrate an ability to work with others harmoniously;
(G) develop responsibility and the ability to follow through on assigned tasks; and
(H) exhibit productive work habits and attitudes.

(6) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:
(A) recognize opportunities and options for business ownership;
(B) identify entry-level procedures, planning processes, and terms needed to open a business; and
(C) develop an understanding of the role of small business in the free enterprise system.

(7) Concepts and skills involving the tools, materials, and processes used in technology. The student shall be provided opportunities to:
(A) become proficient in the use of applicable tools, machines, and equipment;
(B) understand the properties of a wide range of industrial materials through testing;
(C) gain familiarity with the processes of various technologies; and
(D) practice conservation and recycling of industrial materials.

(b) General drafting (visual communications technology - ½-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to general drafting. The student shall be provided opportunities to:
(1) use American National Standards Institute symbols and convenience;
(2) demonstrate freehand sketching techniques;
(3) apply accepted lettering practices and styles;
(4) understand the relationship between points, lines, and planes through multiview drawing principles;

(5) describe objects adequately through the principles of shape and size description;
(6) describe objectives through various pictorial development techniques;
(7) apply drawing techniques suitable for reproduction;
(8) apply the concepts of residential building design and technical drafting;
(9) understand the use of the computer in designing and making working drawings; and
(10) use drawing reproduction and equipment.

(c) Engineering graphics (visual communications technology - ½-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to engineering graphics. The student shall be provided opportunities to:
(1) apply sketching techniques to develop drawing format and graphic problem solving;
(2) demonstrate orthographic projection techniques using advanced applications;
(3) select appropriate drafting convention to describe object shape;
(4) apply descriptive geometry principles in developing revolution, auxiliary and successive auxiliary drawings;
(5) produce working drawings of single and multi-part mechanical devices;
(6) demonstrate the drawing of isometric, obliques, and perspective drawing;
(7) use standard parts charts and tables;
(8) apply the principles of advanced size description relating to tolerance and precision dimensioning;
(9) understand the principles of threads and fasterners and their symbolic application;
(10) understand the use of the computer for designing, plotting, and engineering manufactured products; and
(11) use drawing reproduction equipment.

(d) Technical drafting/advanced technical drafting (visual communications technology - ½-1 unit) shall include the essential elements common to all industrial technology and the following essential elements:
(1) Concepts and skills related to technical drafting. The student shall be provided opportunities to:
(A) use American National Standards Institute symbols and conventions;
(B) understand the use of appropriate techniques and symbols common to selected technical drawing fields such as machine, structural welding, electrical and electronic, piping, topographical, computer-aided drafting, drafting for numerical control, technical illustration, gears and cams, developments, and jigs and fixtures;
(C) use selected charts and tables for making drawings;

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(D) apply sketching techniques to develop drawing format and graphic problem solving;
(E) describe layout and assembly of systems function using appropriate pictorial drawings; and
(F) use drawing reproduction equipment.

(2) Concepts and skills relating to several areas of technical drafting and advanced technical drafting. The student shall be provided opportunities to:
(A) develop production drawings in up to four of the following areas:
(i) machine tools and parts;
(ii) structural steel;
(iii) welding;
(iv) electrical and electronics;
(v) piping;
(vi) topographical;
(vii) computer-aided drafting;
(viii) drafting for numerical control;
(ix) gears and cams;
(x) developments; and
(xi) jigs and fixtures;
(B) apply sketching, projection, and rendering techniques to produce technical illustrations; and
(C) understand the use of the computer for designing, plotting, and engineering manufactured products.

(e) Architectural drafting/advanced architectural drafting (visual communications technology - ½-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to architectural drafting. The student shall be provided opportunities to:
(1) use symbols, lettering, and building standards as published by the American Institute of Architects.
(2) understand minimum standards established by local and state building codes;
(3) select building materials;
(4) identify types of building construction;
(5) investigate basic housing styles;
(6) apply energy conservation practices;
(7) incorporate building safety and security measures into design;
(8) differentiate between residential/commercial and light/heavy construction;
(9) understand the use of the computer in designing, making working drawings, writing specifications, developing cost estimates, and managing construction;
(10) use architectural symbols and procedures to draw floor plans, elevations, foundation plans, plot plans, wall sections and details;
(11) apply design and planning principles to develop floor plan arrangement;
(12) apply technical illustration techniques to produce presentation drawings;

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(13) develop schedules and written specifications; and
(14) use drawing reproduction equipment.

(f) General photography/advanced photography (visual communications technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills in photography. The student shall be provided opportunities to:
(1) define the nomenclature of camera systems;
(2) apply principles of optics and light control;
(3) use artificial lighting techniques;
(4) demonstrate chemical preparation procedures;
(5) understand the principles of video, computer-generated images, and other photographic media;
(6) apply composition techniques in pictures;
(7) understand computer-assisted camera techniques;
(8) produce black and white negatives and prints;
(9) produce color negatives and prints;
(10) produce color transparencies;
(11) evaluate photographic work; and
(12) display photographic work.

(g) General graphic arts/advanced graphic arts (visual communications technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills in graphic arts. The student shall be provided opportunities to:**
(1) use common type styles;
(2) apply design principles;
(3) prepare layout and copy for reproduction processes;
(4) operate mechanical and photographic equipment used in typesetting;
(5) process photographic materials;
(6) use proper exposure and darkroom procedures;
(7) apply appropriate platemaking procedures;
(8) operate lithographic printing equipment;
(9) describe relief printing equipment;
(10) describe gravure reproductions;
(11) use screen printing processes;
(12) use duplicators and copiers;
(13) apply finishing and binding methods;
(14) use various types of paper and ink used in printing;
(15) estimate job costs; and
(16) describe legal restrictions and copyright laws on reproductions.

(h) General computer applications (visual communications technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills in computer applications. The student shall be provided opportunities to:**
(1) become aware of the many uses of computers in industry;
(2) describe the need for different computer languages used in industry;
(3) use different types of input/output devices to simulate those used in industry;
(4) control movements of robotic components;
(5) simulate the use of robots to control industrial processes;

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

(6) study the function codes of computer numerical control;
(7) use computer numerical controlled machines to produce industrial products;
(8) use computer-aided drafting to make working drawings;
(9) simulate the use of computer-aided manufacturing to plan, produce, control, and manage manufacturing processes;
(10) use computer image generation methods to communicate information;
(11) use data base software to assist in collecting, storing, retrieving, and applying information for industrial applications;
(12) use industrial simulation and modeling to solve problems; and
(13) study future uses of computers in industry.

(i) Individual problems in visual communications technology (1/2-1 unit) shall include the essential elements common to industrial technology and the following essential elements and concepts and skills of individual problems. The student shall be provided opportunities to:**
(1) identify a technological problem for individual study;
(2) review literature related to the selected problem;
(3) conduct a study by investigating alternative solutions; and
(4) report findings and conclusions.

(j) General power systems/advanced power systems (energy technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to power systems. The student shall be provided opportunities to:
(1) understand the history of power systems;
(2) understand the development of power systems with the social and industrial implications;
(3) investigate and apply principles of generation, conversion, transmission, and control and use of mechanical and fluid power;
(4) investigate the use of computers to monitor and control power systems;
(5) experiment with internal and external combustion engines;
(6) analyze and experiment with mechanical applications to distribute and utilize power;
(7) test pneumatic and hydraulic control systems;
(8) determine efficiency and output of power systems; and
(9) recognize environmental relationships of power systems.

(k) General electrical systems/advanced electrical systems (energy technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills dealing with electrical systems. The student shall be provided opportunities to:
(1) apply the use of electricity and electronics laws and principles;
(2) investigate atomic theory, sources of electricity, current flow, magnetism, theory and use of meters, simple circuits, simple DC and AC motors, and residential wiring;
(3) demonstrate the use of vacuum tubes, power supplies, amplifiers, oscillators, transmitters, electromatic radiation, receivers, and semiconductors;

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

(4) apply electrical practices involved in storage system;
(5) investigate electromagnetic systems;
(6) understand electro-mechanical systems;
(7) understand microwave laser systems;
(8) investigate the utilization of generators and transformers;
(9) understand the use of computerized circuit controls and program controls;
(10) describe solid state electronics;
(11) survey the mini-component electronic systems;
(12) apply radio and television communications principles;
(13) understand single phase and three-phase concepts; and
(14) investigate security and detector system provided by electronic industry.

(1) General transportation/advanced transportation systems (energy technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to transportation systems. The student shall be provided opportunities to:**

(1) review the history of transportation and the past, present, and future influences upon society;
(2) analyze the advantages, disadvantages, and limitations of various modes of transportation;
(3) analyze the functions of transportation systems in respect to the movement of goods and people;
(4) examine the components of transportation systems including computer controls and automated scheduling systems;
(5) compare transportation systems that utilize electrical, electronic, mechanical, or fluid technologies;
(6) prepare static or working energy transmission and/or conversion models that demonstrate such process or their instrumentation and control;
(7) develop static or working models that demonstrate devices or systems used to move people and materials;
(8) utilize computers to collect and analyze data relevant to transportation systems;
(9) design and control robotic components of transportation systems;
(10) investigate the problems of pollution associated with various forms of transportation;
(11) study the sociocultural implications associated with transportation systems of the future;
(12) review the international, national, state, and local rules and regulations which control transportation systems;
(13) investigate the relationship between transportation, communication, and production;
(14) investigate mass transportation;
(15) read and interpret maps, charts, and schedules; and
(16) study additional support systems which serve the transportation industries.

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

(m) General energy/alternate energy systems (energy technology - 1/2-1 unit) shall include the essential elements common to industrial technology and the following essential elements and concepts and skills related to energy systems. The student shall be provided opportunities to:**

(1) demonstrate the conversion, instrumentation, and control of energy through the exploration of energy conversion and storage;
(2) manipulate apparatus and devices that demonstrate the conversion, storage, and control of the basic form of energy;
(3) construct static or working models or examples of devices that generate, convert, or control energy;
(4) utilize computers to interface instrumentation for monitoring and controlling energy systems;
(5) investigate and predict ecological and conservation problems associated with energy generation and conversion using historical and demographic data;
(6) analyze the advantages, disadvantages, and limitations of various types of contemporary and alternative energy systems;
(7) review the international, national, state, and local rules and regulations which control energy generation and conversion systems; and
(8) utilize robotic and automated devices to control and monitor energy systems.

(n) Individual problems in energy technology (1/2-1 unit) shall include the essential elements common to industrial technology and the following essential elements and concepts and skills of individual problems. The student shall be provided opportunities to:**

(1) identify a technological problem for individual study;
(2) review literature related to the selected problem;
(3) conduct a study by investigating alternative solutions; and
(4) report findings and conclusions.

(o) General construction processes (production technology - 1/2-1 unit) shall shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills of construction. The student shall be provided opportunities to:**

(1) develop an awareness of construction as one of the largest industries in the U.S. and its relationship to the local, state, and national economy;
(2) describe the relationships between management and labor as it relates to the construction of a product;
(3) identify materials used in common structures with emphasis on new materials and new construction methods;
(4) compare the different types of structures and the effects they have upon man's environment and the future;
(5) describe the relationship of capital, management, personnel, and processes in construction;
(6) plan, organize, and construct a structure;
(7) apply the basic principles of foundation, wall, and roof structures;
(8) plan and install utilities;
(9) use construction terminology correctly;
(10) research the historical developments in construction as a basis for analyzing and predicting future construction trends.

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

(11) practice finishing techniques in construction;
(12) analyze and perform servicing and maintenance procedures of structures;
(13) research, design, and construct alternative energy systems for new and existing structures;
(14) explain how construction meets human needs and its impact on the future;
(15) research the financing of homes under current mortgage conditions;
(16) discuss local, state, and national building code requirements;
(17) investigate the principles of supply and demand;
(18) plan the efficient use and reuse of materials;
(19) analyze the social, personal, and ecological effects of cost/benefit decision making;
(20) demonstrate problem-solving techniques in the selection of suitable materials and processes for constructing structures; and
(21) develop positive attitudes regarding the value and dignity of work.

(p) General manufacturing processes (production technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills of manufacturing. The student shall be provided opportunities to:**

(1) develop an awareness of manufacturing as one of the largest industries in the U.S. and its relationship to the local, state, and national economy;
(2) investigate the interrelationship of business, labor, and investors in the economic system;
(3) investigate the source, nature, application, and the relationship of materials used in manufacturing;
(4) identify the different methods of separating, forming, machining, integrating, assembling, and finishing materials;
(5) describe the relationship of capital, management, personnel, and processes in manufacturing;
(6) research, design, engineer, produce, market, and service products;
(7) use manufacturing terminology correctly;
(8) research historical development of manufacturing as a basis for analyzing and predicting future manufacturing trends;
(9) design functional manufacturing facilities to produce a functional product in a cost/effective manner;
(10) investigate the industrial processes employed to fabricate manufacturing materials into functional items;
(11) demonstrate problem-solving techniques in the selection of suitable materials and processes for fabricating various products;
(12) operate management systems as used in manufacturing;
(13) explain the principles of supply and demand;
(14) explore the advantages and disadvantages of specialization to increase efficiency of production and services;
(15) explore application of automated manufacturing systems;
(16) plan the efficient use and reuse of materials;
(17) analyze the social, personal, and ecological effects of cost benefit decision making;
(18) distinguish between collectivism and the free enterprise system;

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

(19) analyze industrial materials on the ecological balance, the utilization and conservation of natural resources, and the recycling capabilities of industrial materials and products;
(20) distinguish the important difference between American manufacturing technology and the manufacturing technology of other leading industrial nations;
(21) evaluate the effects of high technology on manufacturing systems;
(22) integrate high technology systems into manufacturing and mass production activities; and
(23) develop positive attitudes regarding the value and dignity of work.

(q) General woodworking/advanced woodworking (production technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to woodworking. The student shall be provided opportunities to:
(1) apply the industrial processes of material testing, planning, designing, fabricating, finishing, repairing, and refinishing;
(2) select construction materials best suited to a given application;
(3) transform raw materials into finished products;
(4) apply mass production techniques;
(5) demonstrate knowledge and skills in the use of hardware, fasteners, jointery, and adhesives;
(6) understand techniques and processes used in automated production systems;
(7) identify synthetic materials and exotic materials used for furniture and cabinetmaking;
(8) investigate industrial tools, materials, and processes common to the construction, furniture, and cabinetmaking industries; and
(9) understand the use of the computer and robots in manufacturing wood products.

(r) General metalworking/advanced metalworking (production technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills of metalworking. The student shall be provided opportunities to:
(1) develop basic skills in four or more of the following areas:
(A) bench and wrought metal;
(B) machining;
(C) welding;
(D) foundry;
(E) forging and metallurgy;
(F) sheetmetal; and
(G) metal spinning;
(2) investigate the industrial processes of metal coating;
(3) practice metalworking skills and techniques for fabricating, forming, shaping, fastening, bending, cutting, drilling, turning, and finishing;
(4) research powdered metal technology;
(5) understand the oxidation of metals;
(6) apply mass production techniques;
(7) understand the properties and characteristics of metals; and
(8) understand the use of the computer and robots in manufacturing metal products.

(s) General plastics/advanced plastics (production technology - 1/2-1 unit) shall include the essential elements common to all industrial technology and the following essential elements and concepts and skills related to plastics. The student shall be provided opportunities to:

(1) apply basic principles to molding, forming, mold making, bonding, laminating, encapsulating, foams, coating, vinyl dispersion, decorating, and thermofusion;
(2) practice mold making using silicone, urethane, latex, and epoxy;
(3) fabricate with chemicals, hot air, and heat sealing techniques;
(4) laminate with pressurized systems;
(5) apply machining techniques;
(6) use and maintain tools unique to the plastics industry;
(7) apply mass production techniques; and
(8) understand the use of the computer and robots in manufacturing plastics products.

(t) Individual problems in production technology (1/2-1 unit) shall include the essential elements common to industrial technology and the following essential elements and concepts and skills of individual problems. The student shall be provided opportunities to:**

(1) identify a technological problem for individual study;
(2) review literature related to the selected problem;
(3) conduct a study by investigating alternative solutions; and
(4) report findings and conclusions.

**Suggested essential elements not approved by the State Board of Education due to low enrollment.

INSTRUCTIONAL IMPLEMENTATION DESIGN

INSTRUCTIONAL IMPLEMENTATION

If the "Goals for Public School Education" are to achieve their potential impact on instruction in industrial technology, a guide is needed to assist in making classroom activities relate to those goals. The State Board of Education, through the implementation of "House Bill 246", provides approved courses, essential elements, and descriptors for the industrial technology curriculum, constituting approximately sixty-five percent of the instructional program. The remaining thirty-five percent of the curriculum is left to the discretion of the local school to meet its particular needs and interests. The following "Instruction Implementation Model" is designed to assist the profession in planning relevant instructional materials.

Level I development is the responsibility of the State Board of Education and is derived and implemented through the leadership of the Texas Education Agency. This level of development grew out of a legislative mandate "House Bill 246", which includes all of the curriculum areas (disciplines) and courses which constitute the approved instructional programs in Texas.

Level II development is also the responsibility of the State Board of Education and was derived by the industrial technology staff of the Texas Education Agency in cooperation with a curriculum committee of industrial technology teachers and teacher educators in Texas. This work resulted in the list of approved industrial technology courses, and their

essential elements and descriptors, establishing parameters for all approved industrial technology courses in the state.

Level III goals and curriculum are developed by the local school system, consistent with the State mandated essential elements and descriptors noted in Level II.

Level IV development is initiated and developed by the local school (campus). The essential elements and descriptors should be chosen so as to be consistent with district goals and the State guide. The program is planned to meet the needs of the local community, taking into account the funds available, facilities, and strengths of faculty.

Levels V, VI and VII are developed by the individual teacher with assistance from the supervision (if such exists) and faculty of a local school. Curriculum Guides available from the Texas Education Agency may be of assistance at this level of planning. The program planning at these instructional levels should be consistent with the levels I through IV, subject to local constraints and limitations (faculty, facility, and finances). At this level, descriptors appear as competencies and activities which facilitate the integration of the three technology categories into meaningful relationships. This can be achieved more easily in small schools which have only one laboratory. Large, multi-laboratory facilities will likely experience administrative obstacles to the full integration of all three technology clusters. Under these circumstances, vertical integration within each individual technology may be a more workable

approach.

The following instruction implementation model and the illustrations which follow, may be of assistance in planning a program or course of instruction which fulfills the principal purposes of the goals for public school education in Texas.

INSTRUCTION IMPLEMENTATION MODEL

LEVELS OF IMPLEMENTATION		GOALS	CURRICULUM - WHAT IS TO BE TAUGHT		SOURCE OF INFORMATION	
	I	Goals of public schools	Total curriculum of public school - all approved courses		State Board of Education (TEA)	LEVELS I & II MANDATED BY SBOE
	II	Goals of Discipline ITEC	Essential elements of Discipline (ITEC)	Descriptors of (ITEC)	Obtain from TEA in the Industrial Technology Guide	
	III	Goals of local school district	Essential elements of ITEC courses in school district	Descriptors (general competencies common to all ITEC courses in school district)	Determined by administration and faculty in each local school district	LEVELS III THROUGH VII ARE DEVELOPED AT DISTRICT AND SCHOOL LEVELS USING SBOE MANDATED GOALS, ESSENTIAL ELEMENTS, AND DESCRIPTORS AS A GUIDE
	IV	Goals of individual school (campus)	Essential elements of specific ITEC program to be offered in individual school	Descriptors (general competencies common to all ITEC courses in individual school)	Determined by school faculty, consistent with goals of school district	
	V	Course goals	Essential elements for each ITEC course	Competencies appropriate for each ITEC course	Determined by each teacher, consistent with goals of local school	
	VI	Unit goals	Essential elements for ITEC units to be taught	Competencies appropriate for each unit	Determined by the teacher	
	VII	Lesson goals - daily class objectives	Essential elements to which daily activities are applicable	Competencies to be achieved in each lesson	Derived by the classroom teacher	

NOTE: Each level should be as consistent as possible with the implications of the levels above it. TEA curriculum materials below level II are aids to assist in local school curriculum planning

ILLUSTRATED INSTRUCTION MODEL

		GOAL	ESSENTIAL ELEMENT	DESCRIPTOR	SOURCE OF INFORMATION
LEVELS OF IMPLEMENTATION	I	A. (SBOE) Economic occupational competencies	B. (Public School Curriculum)	C. Opportunity for individual participation	A. see SBOE goal#2,p.14 C. see SBOE goal#2, description,p.14
	II	A. Participate as a member of an industrial/ democratic society	B. Leadership concepts and skills	C. Participate in conducting orderly meetings	A. see ITEC objective#3, p.33. B. see ITEC essential element#6,p.35. C. see ITEC descriptor,#6B,p.35.
	III	"	"	Planning a meeting	"
	IV	"	"	"	"
	V	To develop competencies related to personnel topics	Participate in personnel systems	Use parliamentary procedures	Activities developed by teacher
	VI	To develop competencies related to group endeavors	Participate in conducting a group endeavor	Conduct a club meeting	"
	VII	To develop competencies to conduct a committee meeting	Conduct a committee meeting	Participate in opening ceremonies	"

ILLUSTRATED INSTRUCTION MODEL

		GOAL	ESSENTIAL ELEMENT	DESCRIPTOR	SOURCE OF INFORMATION
LEVELS OF IMPLEMENTATION	I	A. (SBOE) Intellectual Discipline	B. Public School Curriculum	C. Participate in free enterprise system	A. see SBOE goal#1,p.14 C. see SBOE descriptor, goal#1,p.14
	II	A. Develop an awareness of skills related to successful employment and explore business practices in a free enterprise system	B. Concepts and skills related to entrepreneurship	C. Develop on understanding of the free enterprise system	A. see goal#2, objectives of ITEC,p. 33 B. see essential element #8,p.35 C. see descriptor 8C ,p.35
	III	"	"	"	-
	IV	"	"	"	-
	V	"	Concepts and skills related to production technology	Plan and implement a mass production activity	Activities developed by teacher
	VI	Competency to apply free enterprise system to manufacturing	Organize a manufacturing enterprise	Plan and implement a manufacturing activity	"
	VII	Acquire competency to plan for manufacturing in a free enterprise system	Plan for manufacturing	Plan and layout a flow chart	"